ENEMY GAS ATTACKS

Notes prepared for the Minister of Health and the Secretary of State for Scotland on the Diagnosis and Treatment of Casualties.

It is of the greatest importance in the national interest that a knowledge of the main clinical features of gas poisoning and of the essentials of treatment should be possessed by every medical man and woman in the country. * The following notes have therefore been prepared for the information of medical practitioners. It is hoped that they may be useful also to others such as nurses, dentists, etc., who may, in an emergency, be called upon to assist in the treatment of gas casualties.

1. **The two main types of poison gas** likely to be used by the enemy are (1) the vesicants (mustard group); and (2) the pulmonary irritants (phosgene group).

I. VESICANTS

2. Of these **MUSTARD GAS** is considered the most important. It accounted for upwards of 70 per cent. of all our gas casualties in the last war. It can be employed in shells and bombs and sprayed from aeroplanes. Its dangers should not, however, be over-emphasised. Its mortality in the British army in the last war was little more than 2 per cent. and 80 per cent. of cases were fit for active duty within a month. *To secure such low figures a high degree of gas-mask and other discipline is clearly necessary.*

3. **THE EARLY SYMPTOMS** (which develop in the course of a few hours) include skin burns varying from a slight erythema to severe blistering and affecting the softer skin and moist surfaces especially; blepharitis and conjunctivitis; laryngitis, tracheitis and bronchitis; vomiting. **THE SEQUELAE** in the graver cases include corneal ulceration, bronchopneumonia and bronchiectasis.

4. **THE LESIONS** may be caused by **vapour or by actual droplets.**

5. **TREATMENT. Droplets** should be immediately removed from exposed skin by dabbing (not wiping) with handkerchief or linen, which should at once be discarded.

* A reprint of the 1940 edition of the War Office Medical Manual of Chemical Warfare (published by H.M. Stationery Office) is now in preparation. This 1941 edition will embody amendments covering recent recommendations for treatment.

When possible bleach ointment or paste or Anti-gas Ointment No. 2 should then be applied to the skin. The next indication is the earliest possible removal of contaminated clothes and footwear and free washing with soap and water.

Treatment of the eyes, if affected, should always be given preference over treatment of the skin. It should include immediate and free irrigation with water. To prevent secondary conjunctival infection, the instillation of Albucid Soluble in a 2·5 per cent. solution, four times daily is recommended.

Later, Atropine, 1 per cent. in ointment or in drops, may be used to counteract the pain of ciliary spasm. Liquid paraffin drops to prevent sticking of the lids may be employed after 12 hours. **Cocaine preparations and bandaging of the eyes must on no account be allowed.** Eye-shades may be used in the early stages.

Blisters should be aspirated with a hypodermic needle and syringe. For **open skin lesions,** after the stage of profuse exudation the recognised surgical treatments for ordinary burns should be employed.

Laryngitis and tracheitis should be treated with steam inhalations.

Bronchitis and bronchopneumonia should be treated on general principles; it is possible that sulphapyridine may prove valuable in preventing the latter.

In the last war there was a high incidence of **functional sequelae,** including photophobia and blepharospasm, aphonia and vomiting. Early reassurance as to the unlikelihood of blindness, discountenancing a too prolonged use of eye-shades, etc., may play an important part in treatment. *Once the early essential treatment has been given mustard gas casualties may be safely evacuated to a distance as stretcher or sitting cases according to their severity.*

In the case of **patients severely injured as well as contaminated with mustard gas,** elaborate washing, etc., will clearly be out of the question, but the clothes should be cut off as quickly as possible and local eye and skin contamination dealt with as effectively as the condition of the patient may allow. The order of urgency in such cases is (i) removal of outer garments and shoes; (ii) methods directed towards saving life and treating shock; (iii) saving the eyes; (iv) cleansing the skin.

6. **Another vesicant gas is LEWISITE.** It is also a lung irritant, a nose irritant and a tear gas.

7. **EARLY SYMPTOMS. Lewisite** is the more readily recognised on account of its early effects on the upper respiratory tract. When present in large quantity on the skin it can be absorbed and cause severe general and visceral symptoms of **arsenical poisoning.**

8. **TREATMENT.** For removal from the **skin** hydrogen peroxide (20 vols) or a 20 per cent. solution of hyperol (urea peroxide) is a most effective counter-agent. If **blisters** occur they should be opened and the raw surface irrigated to lessen the likelihood of absorption. Otherwise the treatment is as for mustard gas, but bleach ointment has no effect on Lewisite.

II. LUNG IRRITANTS

9. Of these, **PHOSGENE** is the most important. It can be employed in shells or bombs.

10. **SYMPTOMS.** When the gas is present in very high concentration early death from **asphyxia** may occur in the case of inadequately protected persons. With the more usual concentrations immediate symptoms may be slight or absent but dangerous symptoms may follow up to several hours after exposure. The likelihood of such symptoms developing is much increased if the exposed subject remains physically active. **Every person who has been exposed to phosgene vapour without gas-mask protection should become a stretcher case as soon as possible.**

11. **TREATMENT.** On arriving in **hospital** or at a **treatment centre,** cases should be grouped into mild, moderate, and severe categories and, if possible, treated separately.

The **" mild " cases** show a reddish flush on the face, increased respiration rate and pain in the chest aggravated by coughing. Absolute rest, fresh air, fluids and nursing are the chief indications, together with careful watching lest any of them pass into one of the graver groups.

The **" moderate " cases** show greater respiratory distress, with varying degrees of pulmonary oedema, **" blue " cyanosis,** distended neck veins, a full strong pulse without great increase in rate. The indications are **continuous oxygen** by nasal catheter or B.L.B. mask (or in the less severe cases intermittent pure oxygen from a nitrous oxide bag), venesection and nursing care.

The **" severe " cases** show collapse, coldness, a weak rapid pulse, and pallor with leaden **" grey " cyanosis** and no distension of the neck veins. There is profuse pulmonary oedema, often with froth pouring from the mouth and nose, and great respiratory distress with shallow and largely diaphragmatic breathing and the chest in the inspiratory position. The indications are **continuous oxygen** in high concentration with the B.L.B. mask or double nasal catheter, the flowmeter delivering at a sufficient rate to maintain a pink colour in cheeks and lips. Venesection should not be attempted

It may be necessary to lower the head and raise the feet to allow the oedema fluid to escape more freely. Morphine is contra-indicated. Atropine and adrenaline are not indicated. Although there is haemoconcentration and increased viscidity of the blood the use of all forms of intravenous fluid is at present considered inadvisable owing to the risk of increasing the pulmonary oedema. Warmth and the most attentive nursing are essential. Patients may be restored to health after as much as 72 hours of continuous oxygen administration.

Pneumonia is an occasional complication. Late sequelae are rare.

It cannot be too much emphasised that oxygen properly administered is a life-saving therapeutic agent both in the "blue" and "grey" cases. Evacuation of phosgene cases to a distance, until they have been pronounced out of danger, should be prohibited. Even the slightest cases should be under observation and at rest for 48 hours.

III. CARBON MONOXIDE

11. Poisoning by CO may result from leakage from gas mains after air-raids or from the explosion of bombs in a confined space. Rest, restorative treatment, artificial respiration and oxygen with carbon dioxide are the chief indications.

IV. TEAR GASES AND NOSE IRRITANTS

12. These do not produce casualties requiring hospital treatment. The main symptoms are lachrymation, sneezing, intense frontal headache, burning mouth and throat, nausea and tightness in the chest. In a gas-free atmosphere the symptoms usually pass off in an hour.

V. THE VITAL IMPORTANCE OF THE GAS-MASK

THE GAS-MASK, IF PROPERLY ADJUSTED AND IN TIME, GIVES FULL PROTECTION TO THE LUNGS AND EYES AGAINST ALL THESE GASES. IT GIVES NO PROTECTION AGAINST CARBON MONOXIDE AND THE POISONOUS EFFECTS THAT MIGHT RESULT. IN THE EVENT OF GAS ATTACK THE MEDICAL PROFESSION WOULD HAVE A MOST IMPORTANT PART TO PLAY, NOT ONLY IN THE RECOGNITION AND THE TREATMENT OF CASES AND THE RECORDING OF ANY NEW PHENOMENA, BUT ALSO IN THE PREVENTION OF PANIC BY CONSTANT REASSURANCE, BY INSISTENCE ON GAS-MASK DISCIPLINE AND BY STRESSING THE EFFECTIVENESS OF THE PROTECTIVE AND THERAPEUTIC MEASURES AT OUR DISPOSAL.

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